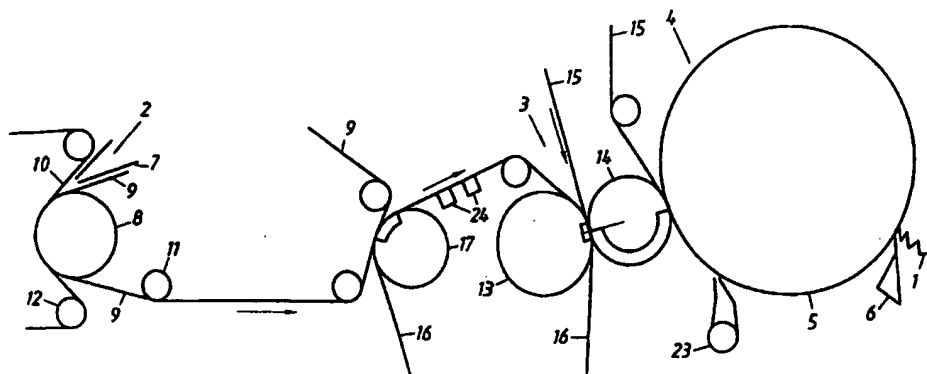




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(54) Title: PAPER MACHINE AND METHOD OF MANUFACTURING A PAPER WEB



(57) Abstract

A paper machine for manufacturing a paper web, comprising a wet section (2) including a headbox (7), a former, a clothing that carries a formed paper web from the former; a press section (3) including a shoe press having a shoe press roll (13) and a counter roll (14); and a drying section (4) including a drying cylinder (5), close to which said counter roll being arranged, whereby the shoe press roll and counter roll form an extended, first press nip and counter roll and drying cylinder form a second press nip, in and after which the paper web (1) is transferred to the drying cylinder. According to the invention the shoe press has a first endless clothing (16) which carries the formed paper web up to the extended press nip and which runs in a loop around the shoe press roll through the extended press nip, and a second endless clothing (15) which is in the form of a felt running in a loop in which the counter roll is situated, through the extended, first press nip and through the second press nip. A method is also described for manufacturing a paper web in such a paper machine.

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Paper machine and method of manufacturing a paper web

The present invention relates to a paper machine for manufacturing a paper web, comprising:

- 5 a wet section including a headbox, a former, a clothing that carries a formed paper web from the former;
a press section including a shoe press having a shoe press roll and a counter roll; and
a drying section including a drying cylinder close to
10 which said counter roll being arranged, whereby the shoe press roll and said counter roll form an extended, first press nip and said counter roll and drying cylinder form a second press nip, in and after which the paper web is transferred to the drying cylinder.

15

The invention also relates to a method of manufacturing a paper web in a paper machine comprising:

- a wet section including a headbox, a former, a clothing that carries a formed paper web from the former;
20 a press section including a shoe press having a shoe press roll and a counter roll; and
a drying section including a drying cylinder close to which said counter roll being arranged, whereby the shoe press roll and said counter roll form an extended, first
25 press nip and said counter roll and drying cylinder form a second press nip, in and after which the paper web is transferred to the drying cylinder.

- In the present patent application the expression
30 "soft paper" refers to creped paper for sanitary use and household purposes. The expression "machine-glazed paper" refers in the present patent application to paper which has been made smooth and glossy on one side by drying on a Yankee cylinder or the like, the other side remaining
35 relatively rough.

US-5,393,384, see particularly Figure 6, shows a paper machine having an impermeable belt which runs in a loop through an extended press nip formed by a shoe press roll and a counter roll. A press felt is passed directly to the press nip, where it is brought together with the impermeable belt and the paper web. The paper web is transferred from a forming wire to the impermeable belt which is to carry the paper web on its under side to the press nip and then transfer the paper web to the drying cylinder. According to the patent specification the adhesion force between the impermeable belt and the paper web is greater than that between the press felt and the paper web. The impermeable belt in question here has a smooth, web-carrying surface. It is generally known that such a smooth, impermeable belt obtains a film of liquid on its smooth, web-carrying surface when the belt, press felt and paper web pass together through a press nip and that, after the press nip, the paper web therefore adheres to the impermeable belt instead of to the press felt which does not have a smooth surface, when the press felt and the impermeable belt run from each other. This situation is also utilized in US-4,483,745. Since, however, both the impermeable belt and the drying cylinder in the paper machine according to US-5,393,384 have smooth surfaces with which the paper web is intended to come into contact, there is a great risk of the paper web continuing to adhere to the smooth surface of the impermeable-belt after it is passed the nip at the drying cylinder instead of being transferred to the smooth surface to the drying cylinder, as is desired. Probably not even the application of large quantities of adhesive on the envelope surface of the drying cylinder would ensure adhesion of the paper web to the drying cylinder.

WO 94/28240 describes a compact roll press in a paper machine for thin paper. A smooth first roll and a second roll form a first press nip through which a web-carrying

felt runs. The second roll may be a suction roll or a blind-drilled roll. The smooth first roll carries the web to a second extended press nip which it forms together with a shoe press roll. The smooth, first roll then carries the web to a large cylinder, which may be a Yankee cylinder, from which the web can be creped. This arrangement eliminates free draw of the paper web. No fabric is present in the nip between the drying cylinder and press roll with smooth surface. No dewatering can therefore occur in the latter nip.

US-5,500,092 describes a paper machine for the production of tissue paper having a press unit consisting of a suction press roll, a shoe press roll and a press roll with smooth surface, which press roll defines a nip with a drying cylinder. The press roll with the smooth surface also forms a press nip with the suction press roll and an extended press nip with the shoe press roll. A felt is passed through the two last-mentioned press nips and is returned to a place upstream via turning rolls, after having passed the extended press nip. The paper web is carried by said felt and runs through the two press nips together with the felt. After the extended press nip the paper web is carried by the press roll with smooth surface and transferred from this to the drying cylinder when the paper web runs into the nip between them, as illustrated in the drawings in this patent. No fabric is present in the nip between the drying cylinder and the press roll with smooth surface. Since both press roll and drying cylinder have smooth surfaces there is a risk of the web accompanying the smooth press roll after the nip instead of adhering to the drying cylinder. Furthermore, the press roll with the smooth surface will be subjected to high temperatures at the nip with the drying cylinder and will then cool down after the nip during its continued rotation. Such temperature fluctuations in the press roll with smooth surface are unfavourable. The nip

is described as a press nip but it is not possible to take care of any water pressed out of the web.

5 The object of the present invention is to provide an improved paper machine of the type described in the introduction, which has a press section with two press nips but which is still compact, and which paper machine ensures that the paper web follows the intended path of run. It is also an object of the invention to provide an
10 improved method of manufacturing a paper web using such a paper machine.

The paper machine according to the invention is characterized in that the shoe press has a first endless
15 clothing which carries the formed paper web up to said extended, first press nip and which runs in a loop around the shoe press roll through the extended first press nip, and a second endless clothing which constitutes a felt running in a loop in which the counter roll is situated,
20 through the extended, first press nip and through the second press nip.

The method according to the invention is characterized in that the formed paper web is carried by a first endless
25 clothing of the shoe press, up to said extended, first press nip, which first clothing runs in a loop around the shoe press roll through the extended first press nip, and in that, at least in the press nip, the paper web is brought into contact with a second endless clothing which
30 constitutes a felt running in a loop in which the counter roll is situated, through the extended, first press nip and through the second press nip.

The invention is described in more detail in the
35 following with reference to the drawings.

Figure 1 shows a paper machine for manufacturing a paper web of soft paper according to a first embodiment of the invention.

5 Figure 2 shows a paper machine for manufacturing a paper web of soft paper according to a second embodiment of the invention.

10 Figure 3 shows a paper machine for manufacturing a paper web of soft paper according to a third embodiment of the invention.

Figure 4 shows a paper machine for manufacturing a paper web of soft paper according to a fourth embodiment of the invention.
15

Figure 5 shows a paper machine for manufacturing a paper web of soft paper according to a fifth embodiment of the invention.
20

Figure 6 shows a paper machine for manufacturing a paper web of machine-glazed paper according to a sixth embodiment of the invention.

25 Figure 7 shows a paper machine for manufacturing a paper web of machine-glazed paper according to a seventh embodiment of the invention.

30 Figure 1 shows schematically parts of a paper machine for manufacturing a fiber web 1 of soft paper such as tissue and other sanitary paper products. The paper machine comprises a wet section 2, a press section 3 and a drying section 4. The drying section 4 comprises a drying cylinder 5, the envelope surface of which is sufficiently
35 strong to withstand high pressures such as those occurring during pressing of the paper web. The drying cylinder 5 is suitably a Yankee cylinder. The wet section

2 comprises a headbox 7 and a former, which may be generally designed as a double-wire former with a forming roll 8, an endless, carrying, inner clothing 9 and an endless covering, outer clothing 10 consisting of a wire.

5 The inner and outer clothings 9, 10 run, each in its own loop, around a plurality of guide rolls 11, 12. The inner clothing 9 may consist of a substantially impermeable belt, a wire or a felt. The press section 3 comprises a shoe press with a shoe press roll 13 and a counter roll

10 14, and a first endless clothing 16 running in a loop around the shoe press roll 13. The shoe press roll 13 and counter roll 14 between them form an extended, first press nip. The counter roll 14 is arranged close to the drying cylinder 5 to form a second press nip therewith.

15 The press section 3 also has a second endless clothing 15 which is in the form of a press felt and which runs in a loop around guide rolls and around the counter roll 14 so that it passes through the extended, first press nip and the second press nip between the counter roll 14 and

20 drying cylinder 5.

In the embodiment according to Figure 1 the web is transferred from the inner clothing 9 to the clothing 16, which is a pick-up felt, with the aid of a suction roll

25 17. The pick-up felt 16 passes two suction boxes 24 and through the extended, first press nip. This embodiment thus has a double-felted, extended, first press nip. The counter roll 14 is a suction roll which, via the press felt 15, takes care of the water pressed out of the paper

30 web to the press felt 15.

A suitable adhesive is applied with the aid of an application device 23 on the envelope surface of the drying cylinder 5 just before the second press nip.

The paper web 1 is creped off the drying cylinder 5 by means of a creping doctor 6, and is then conveyed to a reel-up (not shown).

5 Figure 2 shows schematically a paper machine similar to that in Figure 1 except for the counter roll 14 which in this case is a grooved roll which, via the press felt 15, takes care of the water pressed out of the paper web to the press felt 15. The loop of the press felt 15 is
10 extended after the extended, first press nip so that the press felt 15 runs around two guide rolls 25 and thereafter to the second press nip. The press water running down from the grooved roll is collected in a suitable device (not shown) situated in the space below
15 the grooved roll inside the loop of the press felt 15. According to an alternative embodiment (not shown), the grooved roll is replaced by a blind-drilled roll.

Figure 3 shows schematically parts of a paper machine for
20 manufacturing a fiber web 1 of soft paper such as tissue and other sanitary paper products. The paper machine comprises a wet section 2, a press section 3 and a drying section 4. The drying section 4 comprises a drying cylinder 5, the envelope surface of which is sufficiently
25 strong to withstand high pressures such as those occurring during pressing of the paper web. The drying cylinder 5 is suitably a Yankee cylinder. The wet section 2 comprises a headbox 7 and a former, which may be generally designed as a double-wire former with a forming
30 roll 8, an endless, carrying, inner clothing 9 and an endless, covering, outer clothing 10 consisting of a wire. The inner and outer clothings 9, 10 run, each in its own loop, around a plurality of guide rolls 11, 12. The inner clothing 9 may consist of a substantially
35 impermeable belt, a wire or a felt. The press section 3 comprises a shoe press with a shoe press roll 13 and a counter roll 14, and a first endless clothing 16 passing

around the shoe press roll 13. The shoe press roll 13 and counter roll 14 between them form an extended, first press nip. The counter roll 14 is arranged close to the drying cylinder 5 to form a second press nip therewith.

5 The press section 3 also has a second endless clothing 15 which is in the form of a press felt and which runs in a loop through the extended, first press nip and the second press nip between the counter roll 14 and drying cylinder 5.

10

In the embodiment according to Figure 3 the inner clothing 9 runs from the wet section 2 to the press section 3 and there also forms the first clothing 16 of the shoe press, which clothing 16 runs around the shoe press roll 13 through the extended, first press nip. When the inner clothing 9, i.e. said other clothing 16, is a felt a double-felted, extended first press nip is also obtained in this embodiment. When the inner clothing 9 is a felt or wire it runs past two suction boxes 24. The counter roll 14 is a grooved roll which, via the press felt 15, takes care of the water pressed out of the paper web to the press felt 15.

25 The loop of the press felt 15 is extended after the extended first press nip so that the press felt 15 runs around two guide rolls 25 and then on to the second press nip. The press water running down from the grooved roll 14 is collected in a suitable receptacle (not shown) situated in the space below the grooved roll 14 inside the loop of the press felt 15. According to an alternative embodiment (not shown) the grooved roll is replaced by a blind-drilled roll. According to yet another alternative embodiment (not shown) the counter roll 14 is a suction roll and the press felt 15 thus runs as shown in Figure 1, i.e. without said extension of the loop of the press felt 15 and without the guide rolls 25.

An application device 23 is used to apply a suitable adhesive on the envelop surface of the drying cylinder 5 immediately prior to the second press nip.

- 5 The paper web 1 is creped off the drying cylinder 5 with the aid of a creping doctor 6, and is then conveyed to a reel-up (not shown).

10 Figure 4 shows schematically a paper machine turned upside down in relation to that shown in Figure 3 so that the paper web moves in upward direction towards and through the extended first press nip and then encounters a downwardly moving surface of the drying cylinder 5 in the second press nip. The paper machine is otherwise
15 similar to that according to Figure 3 with the exception of the counter roll 14 which in this case is a suction roll which, via the press felt 15, takes care of the water pressed out of the paper web to the press felt 15.

20 Figure 5 shows schematically parts of a paper machine for manufacturing a fiber web 1 of soft paper such as tissue and other sanitary paper products. The paper machine comprises a wet section 2, a press section 3 and a drying section 4. The drying section 4 comprises a drying
25 cylinder 5, the envelope surface of which is sufficiently strong to withstand high pressures such as those occurring during pressing of the paper web. The drying cylinder 5 is suitably a Yankee cylinder. The wet section 2 comprises a headbox 7 and a former which is a
30 double-wire former of the crescent former type with a forming roll 8, an endless, carrying, inner clothing 9, which consists of a wire, and an endless, covering, outer clothing 10, also consisting of a wire. The inner and outer clothings 9, 10 run, each in its own loop, around a
35 plurality of guide rolls 11, 12. The press section 3 comprises a shoe press with a shoe press roll 13 and a counter roll 14, and a first endless clothing 16 running

in a loop around the shoe press roll 13. The shoe press roll 13 and counter roll 14 between them form an extended, first press nip. The counter roll 14 is arranged close to the drying cylinder 5 to form a second press nip therewith. The press section 3 also has a second endless clothing 15 which is in the form of a press felt and which runs in a loop through the extended, first press nip and the second press nip between the counter roll 14 and the drying cylinder 5.

10

In the embodiment according to Figure 5 the web is transferred from the outer clothing 10 to the clothing 16 which may be a pick-up felt, with the aid of a suction roll 17. The clothing 16 may also be an impermeable transfer belt. The pick-up clothing 16 runs through the extended, first press nip. When the pick-up clothing 16 is a felt a double-felted, extended first press nip is also obtained in this embodiment. When the pick-up clothing 16 is a felt it runs past two suction boxes 24. The counter roll 14 is a grooved roll which, via the press felt 15, takes care of the water pressed out of the paper web to the press felt 15.

The loop of the press felt 15 is extended after the extended first press nip so that the press felt 15 runs around two guide rolls 25 and then on to the second press nip. The press water running down from the grooved roll 14 is collected in a suitable device (not shown) situated in the space below the grooved roll 14 inside the loop of the press felt 15. According to an alternative embodiment (not shown) the grooved roll is replaced by a blind-drilled roll. According to yet another alternative embodiment (not shown) the counter roll 14 is a suction roll and the press felt 15 thus runs as shown in Figure 1, i.e. without said extension of the loop of the press felt 15 and without the guide rolls 25.

An application device 23 is used to apply a suitable adhesive on the envelop surface of the drying cylinder 5 immediately prior to the second press nip.

- 5 The paper web 1 is creped off the drying cylinder 5 with the aid of a creping doctor 6, and is then conveyed to a reel-up (not shown).

Figure 6 shows schematically parts of a paper machine for manufacturing a fiber web 1 of machine-glazed paper. The paper machine comprises a wet section 2, a press section 3 and a drying section 4. The drying section 4 comprises a drying cylinder 5, the envelope surface of which is sufficiently strong to withstand high pressures such as those occurring during pressing of the paper web. The drying cylinder 5 is suitably a Yankee cylinder. The wet section 2 comprises a headbox 7 and a former, which can be generally called a fourdrinier former, having a couch roll 19 and an endless clothing 18 in the form of a wire running in a loop around the couch roll 19, a wire suction roll 20 and a plurality of guide rolls 21. The press section 3 comprises a shoe press with a shoe press roll 13 and a counter roll 14, and a first endless clothing 16 running in a loop around guide rolls 22 and the shoe press roll 13. The shoe press roll 13 and counter roll 14 between them form an extended, first press nip. The counter roll 14 is arranged close to the drying cylinder 5 to form a second press nip therewith. The press section 3 also has a second endless clothing 15 which is in the form of a press felt and which runs in a loop through the extended, first press nip and the second press nip between the counter roll 14 and the drying cylinder 5.

- 35 In the embodiment according to Figure 6 the web is transferred in an open draw from the wire 18 to the clothing 16 which may be a pick-up felt or an impermeable

- pick-up belt. The pick-up clothing 16 passes around the extended, first press nip. When the pick-up clothing 16, is a felt a doublefelted, extended first press nip is also obtained in this embodiment. When the pick-up
- 5 clothing 16 is a felt it runs past two suction boxes 24. The counter roll 14 is a grooved roll which, via the press felt 15, takes care of the water pressed out of the paper web to the press felt 15.
- 10 The loop of the press felt 15 is extended after the extended first press nip so that the press felt 15 runs around two guide rolls 25 and then on to the second press nip. The press water running down from the grooved roll
- 15 14 is collected in a suitable device (not shown) situated in the space below the grooved roll 14 inside the loop of the press felt 15. According to an alternative embodiment (not shown) the grooved roll is replaced by a
- 20 blind-drilled roll. According to yet another alternative embodiment (not shown) the counter roll 14 is a suction roll and the press felt 15 thus runs in the way shown in Figure 1, i.e. without said extension of the loop of the press felt 15 and without the guide rolls 25.
- The paper web leaves the drying cylinder 5 in a direction
- 25 tangential to and around a guide roll 26, to be conveyed to a reel-up (not shown). The reference number 27 indicates a cleaning doctor arranged to scrape deposits off the envelope surface.
- 30 Figure 7 shows schematically parts of a second paper machine for manufacturing a fiber web 1 of machine-glazed paper. The paper machine comprises a wet section 2, a press section 3 and a drying section 4. The drying
- 35 section 4 comprises a drying cylinder 5, the envelope surface of which is sufficiently strong to withstand high pressures such as those occurring during pressing of the paper web. The drying cylinder 5 is suitably a Yankee

cylinder. The wet section 2 comprises a headbox 7 and a former, which can be generally called a fourdrinier former, having a couch roll 19 and an endless clothing 18 in the form of a wire running in a loop around the couch roll 19, a wire suction roll 20 and a plurality of guide rolls 21. The press section 3 comprises a shoe press with a shoe press roll 13 and a counter roll 14, and a first endless clothing 16 running in a loop around a suction roll 17, guide rolls 22 and the shoe press roll 13. The shoe press roll 13 and counter roll 14 between them form an extended, first press nip. The counter roll 14 is arranged close to the drying cylinder 5 to form a second press nip therewith. The press section 3 also has a second endless clothing 15 which is in the form of a press felt and which runs in a loop through the extended, first press nip and the second press nip between the counter roll 14 and the drying cylinder 5.

In the embodiment according to Figure 7 the web is transferred from the wire 18 to the clothing 16, which is a pick-up felt, with the aid of the suction roll 17. The pick-up clothing 16 runs through the extended, first press nip. This embodiment thus has a double-felted, extended first press nip. The counter roll 14 is a grooved roll which, via the press felt 15, takes care of the water pressed out of the paper web to the press felt 15.

With the aid of the pick-up felt 16 the paper web is conveyed in upward direction towards and through the extended, first press nip and then encounters a downwardly moving surface of the drying cylinder 5 at the second press nip.

The loop of the press felt 15 is extended after the extended first press nip so that the press felt 15 runs around two guide rolls 25 and then on to the second press

nip. The press water spraying upwards from the grooved roll 14 is collected in a suitable device (not shown) situated in the space above the grooved roll 14 inside the loop of the press felt 15. According to an
5 alternative embodiment (not shown) the grooved roll is replaced by a blind-drilled roll. According to yet another alternative embodiment (not shown) the counter roll 14 is a suction roll, in which case the press felt 15 runs in the way shown in Figure 4, i.e. without said
10 extension of the loop of the press felt 15 and without the guide rolls 25.

The paper web leaves the drying cylinder 5 in a direction tangential to and around a guide roll 26, to be conveyed
15 to a reel-up (not shown). The reference number 27 indicates a cleaning doctor arranged to scrape deposits off the envelope surface.

In the paper machines described and illustrated, the
20 extended, first press nip of the shoe press is separated from the drying cylinder. However, the distance is in any case so short between the extended first press nip and the drying cylinder that the risk of the web becoming rewetted by the felt is slight, even when the loop of the
25 press felt 15 is extended after the extended, first press nip to pass around the two guide rolls 25.

In the embodiments according to Figures 1, 2, 5 and 7 the suction roll 17 can in certain cases be replaced by a
30 smooth roll, one or more suction boxes or a suitable guide element which alters the direction of the pick-up felt 16.

In the production of soft paper in the paper machines in
35 accordance with Figures 1-5, the dry solids content of the paper web before the extended first press nip is within the interval 12-16%. After the extended first

press nip the dry solids content has risen to 40-45%.
With the aid of additional pressing in the second press
nip a dry solids content of 45-50% is obtained. The
equivalent values when manufacturing machine-glazed paper
5 with the machines in accordance with Figures 6 and 7 are
15-20%, 35-40% and 40-45%, respectively.

Pressing in a shoe press at low and moderate linear
loads, i.e. low pressure, gives a paper web with high
10 bulk, which promotes the properties of the soft paper.
Under different conditions such as high linear load and
high tilt, i.e. high pressure, pressing in a shoe press
instead gives maximum dry solids content and high
density, which promotes the properties of machine-glazed
15 paper. A high-beaten pulp is generally used for making
machine-glazed paper, whereas low-beaten pulp is used for
making soft paper.

In all the embodiments described the drying cylinder 5 is
20 also used for pressing the paper web. The drying cylinder
has a hot envelope surface which is beneficial to the
pressing process.

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C L A I M S

1. A paper machine for manufacturing a paper web (1), comprising:
- 5 a wet section (2) including a headbox (7), a former, a clothing (9 or 10) that carries a formed paper web (1) from the former;
- a press section (3) including a shoe press having a shoe press roll (13) and a counter roll (14); and
- 10 a drying section (4) including a drying cylinder (5) close to which said counter roll (14) being arranged, whereby the shoe press roll (13) and said counter roll (14) form an extended, first press nip and said counter roll (14) and drying cylinder (5) form a second press
- 15 nip, in and after which the paper web (1) is transferred to the drying cylinder, characterized in that the shoe press has a first endless clothing (16) which carries the formed paper web (1) up to said extended, first press nip and which runs in a
- 20 loop around the shoe press roll (13) through the extended first press nip, and a second endless clothing (15) which is in the form of a felt running in a loop in which the counter roll (14) is situated, through the extended, first press nip and through the second press nip.
- 25
2. A paper machine as claimed in claim 1 for manufacturing a paper web of soft paper, characterized in that said first clothing (16) is a pick-up felt, and said clothing (9) carrying the formed web (1) from the former
- 30 is an impermeable belt, a wire or a felt, from which the web (1) is transferred to said first clothing (16).
3. A paper machine as claimed in claim 1 for manufacturing a paper web of soft paper, characterized in
- 35 that said first clothing (16) is a pick-up felt or an impermeable belt, and said clothing (10) carrying the

formed web (1) from the former is a wire from which the web (1) is transferred to said first clothing (16).

4. A paper machine as claimed in claim 1 for
5 manufacturing a paper web of soft paper, characterized in that said first clothing (16) and said clothing (9) carrying the formed web (1) from the former constitute one and the same clothing in the form of an impermeable belt, a wire or a felt.

10

5. A paper machine as claimed in claim 1 for
manufacturing a paper web of machine-glazed paper,
characterized in that said first clothing (16) is a
pick-up felt or an impermeable transfer belt, and said
15 clothing (18) carrying the formed web (1) from the former is a wire having flat run, from which the web (1) is transferred in an open draw to said first clothing (16).

6. A paper machine as claimed in any of the preceding
20 claims, characterized in that the counter roll (14) is a grooved roll, a suction roll or a blind-drilled roll.

7. A paper machine as claimed in any of claims 1-5,
characterized in that the counter roll (14) is a suction
25 roll and that the press felt (15) runs in contact with the suction roll (14) from the extended, first press nip to the second press nip.

8. A paper machine as claimed in any of claims 1-5,
30 characterized in that the counter roll (14) is a grooved roll or a blind-drilled roll, and that the loop of the press felt (15) is extended after the extended, first press nip and runs around one or more guide rolls (25) before the second press nip.

35

9. A paper machine as claimed in any of the preceding claims, characterized in that the paper web is arranged

to be guided in a direction obliquely downwards towards the extended, first press nip and is arranged to encounter an upwardly moving surface of the drying cylinder (5) at the second press nip.

5

10. A paper machine as claimed in any of claims 1-8, characterized in that the paper web is arranged to be guided in a direction straight or obliquely upwards towards the extended, first press nip and is arranged to encounter a downwardly moving surface of the drying cylinder (5) at the second press nip.

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11. A paper machine as claimed in any of claims 2-4, characterized in that the extended, first press nip is arranged to provide the paper web with a dry solids content of 40-45% and the second press nip of 45-50%.

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12. A paper machine as claimed in claim 5, characterized in that the extended, first press nip is arranged to provide the paper web with a dry solids content of 35-40% and the second press nip of 40-45%.

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13. A method of manufacturing a paper web (1) in a paper machine comprising:

25

a wet section (2) including a headbox (7), a former, a clothing (9 or 10) that carries a formed paper web (1) from the former;
a press section (3) including a shoe press having a shoe press roll (13) and a counter roll (14); and
a drying section (4) including a drying cylinder (5) close to which said counter roll (14) being arranged, whereby the shoe press roll (13) and said counter roll (14) form an extended, first press nip and said counter roll (14) and drying cylinder (5) form a second press nip, in and after which the paper web (1) is transferred to the drying cylinder,

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characterized in that the formed paper web (1) is carried by a first endless clothing (16) of the shoe press, up to said extended, first press nip, which first clothing runs in a loop around the shoe press roll (13) through the
5 extended first press nip, and in that, at least in the press nip, the paper web is brought into contact with a second endless clothing (15) which is in the form of a felt running in a loop in which the counter roll (14) is situated, through the extended, first press nip and
10 through the second press nip.

14. A method as claimed in claim 13, characterized in that the paper web is guided in a direction obliquely downwards towards the extended, first press nip and
15 encounters an upwardly moving surface of the drying cylinder (5) at the second press nip.

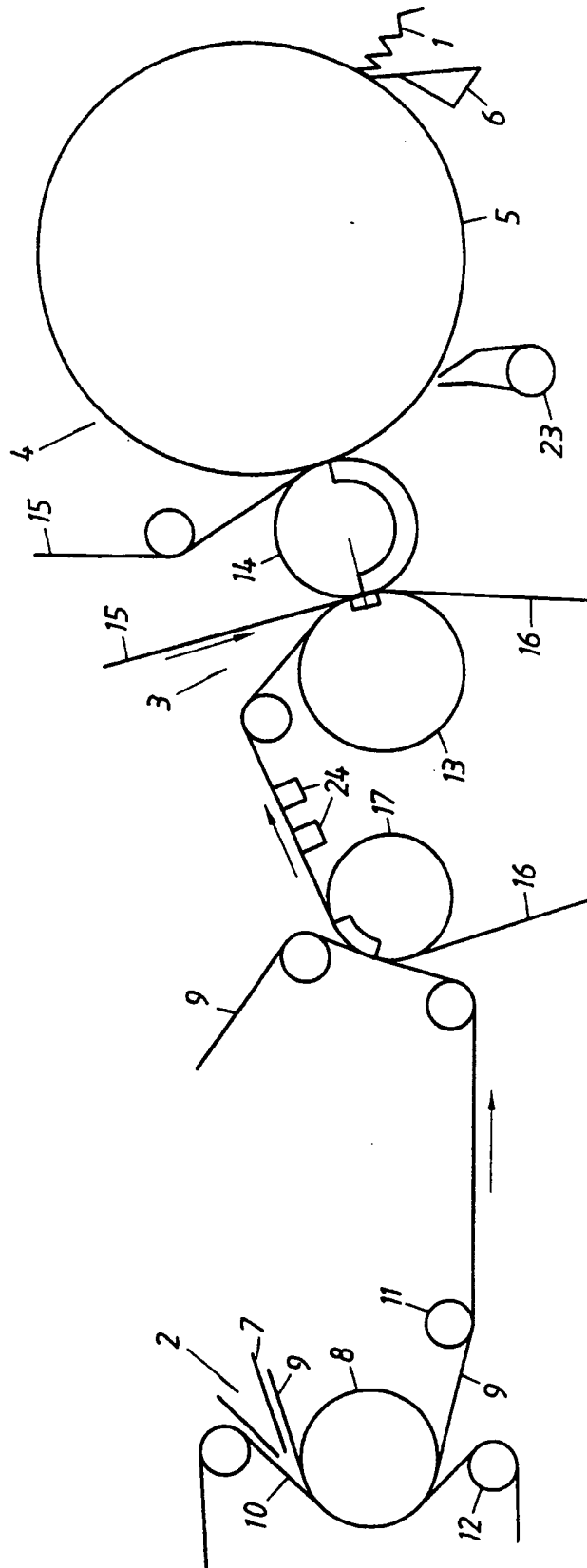
15. A method as claimed in claim 13, characterized in that the paper web is guided in a direction straight or
20 obliquely upwards towards the extended, first press nip and encounters a downwardly moving surface of the drying cylinder (5) at the second press nip.

16. A method as claimed in claim 13 for manufacturing
25 soft paper, characterized in that the extended, first press nip provides the paper web with a dry solids content of 40-45% and the second press nip of 45-50%.

17. A method as claimed in claim 13 for manufacturing
30 machine-glazed paper, characterized in that the extended, first press nip provides the paper web with a dry solids content of 35-40% and the second press nip of 40-45%.

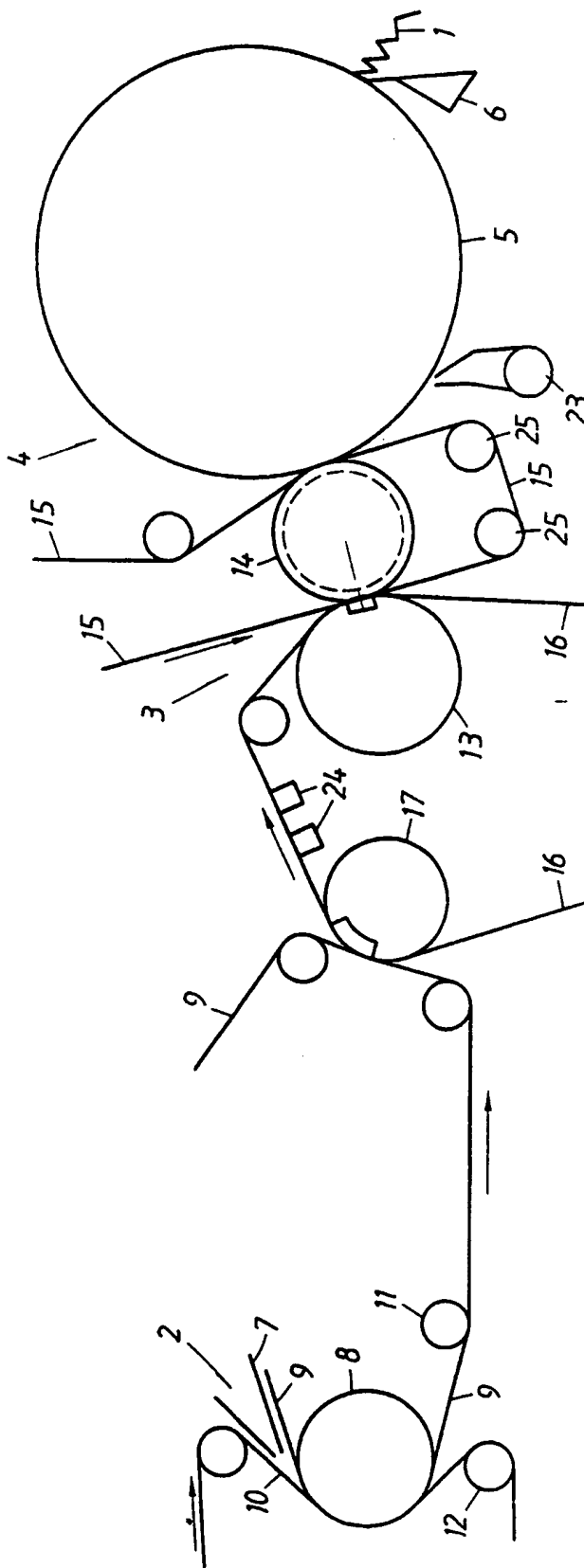
1 / 7

Fig. 1



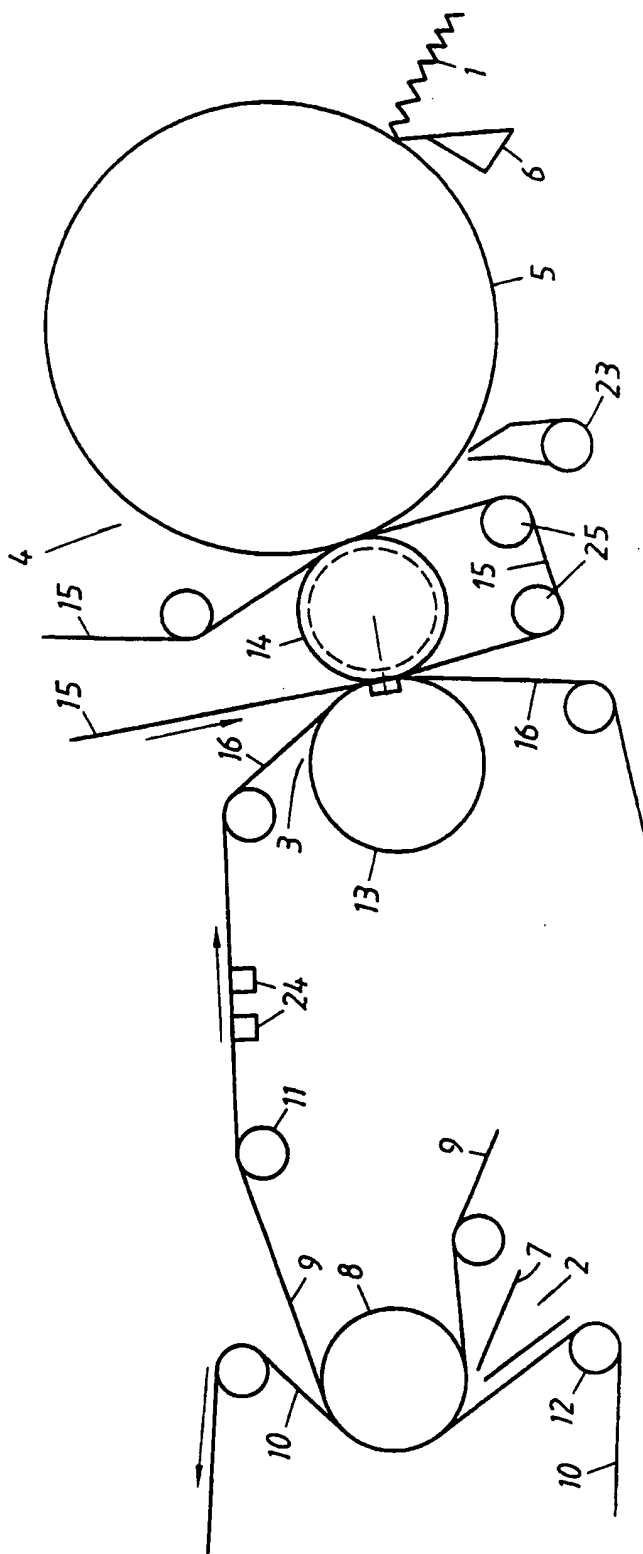
2 / 7

Fig. 2



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Fig. 3



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Fig. 4

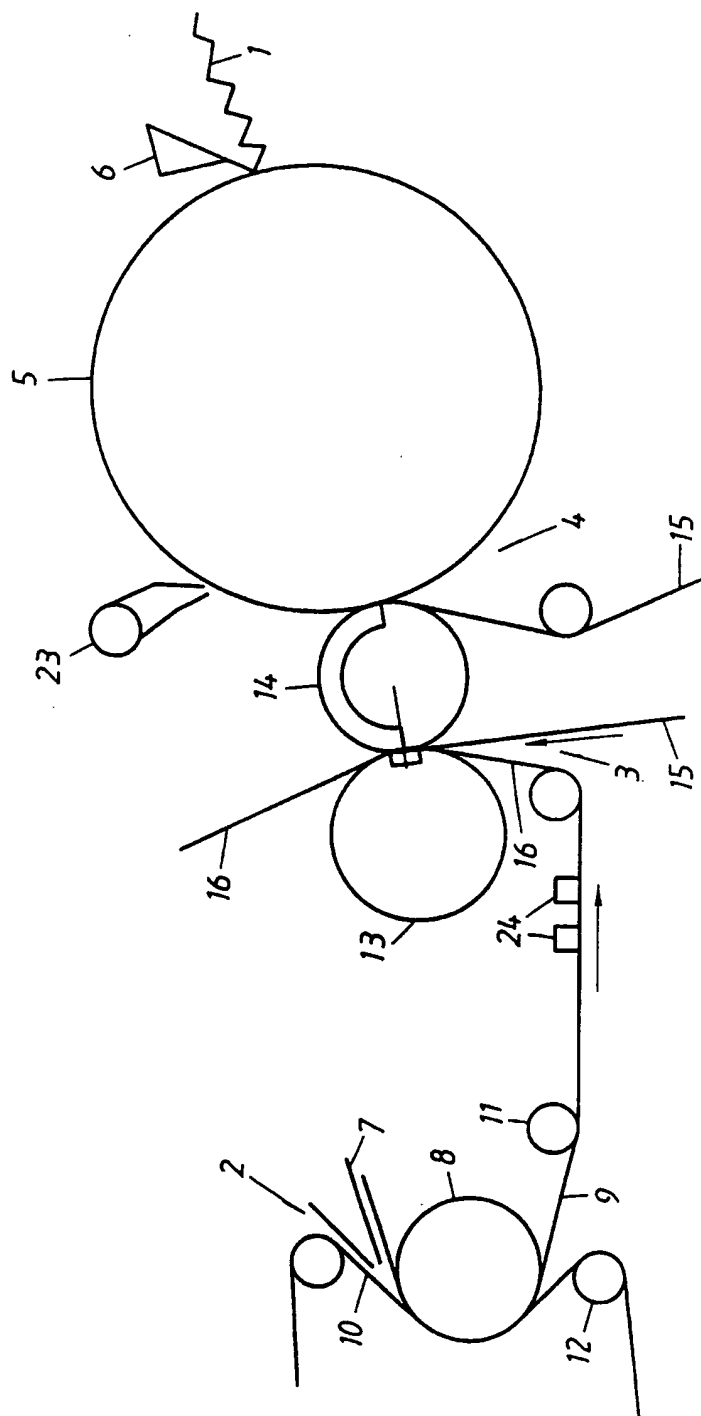
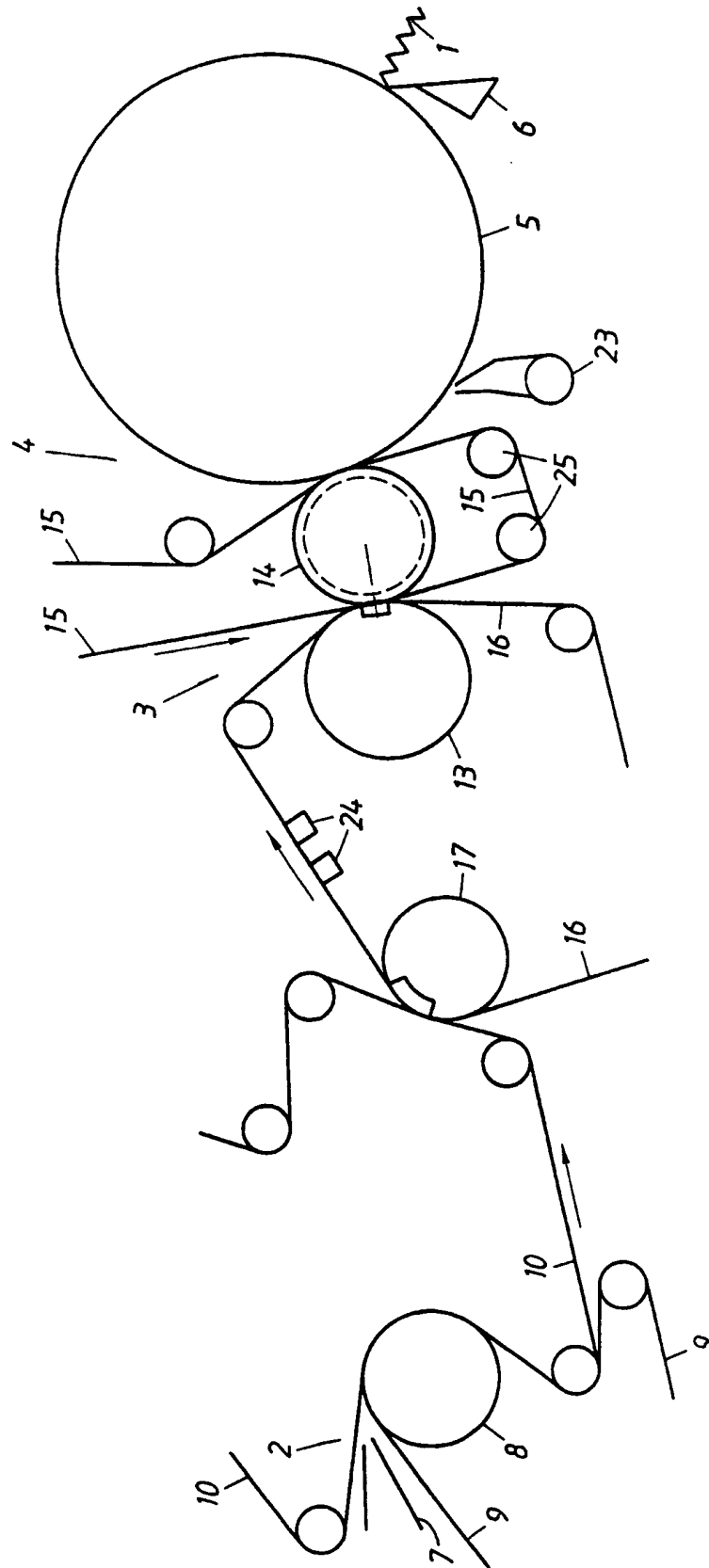


Fig. 5



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Fig. 6

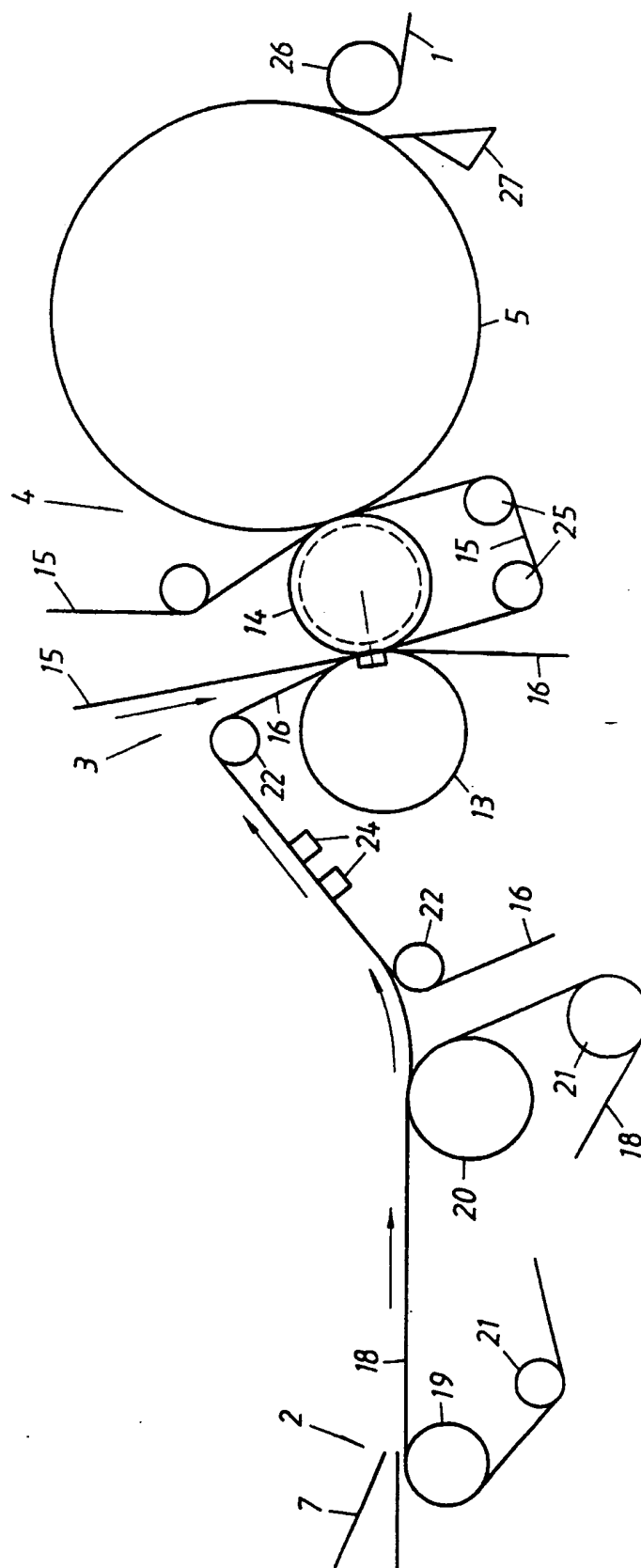
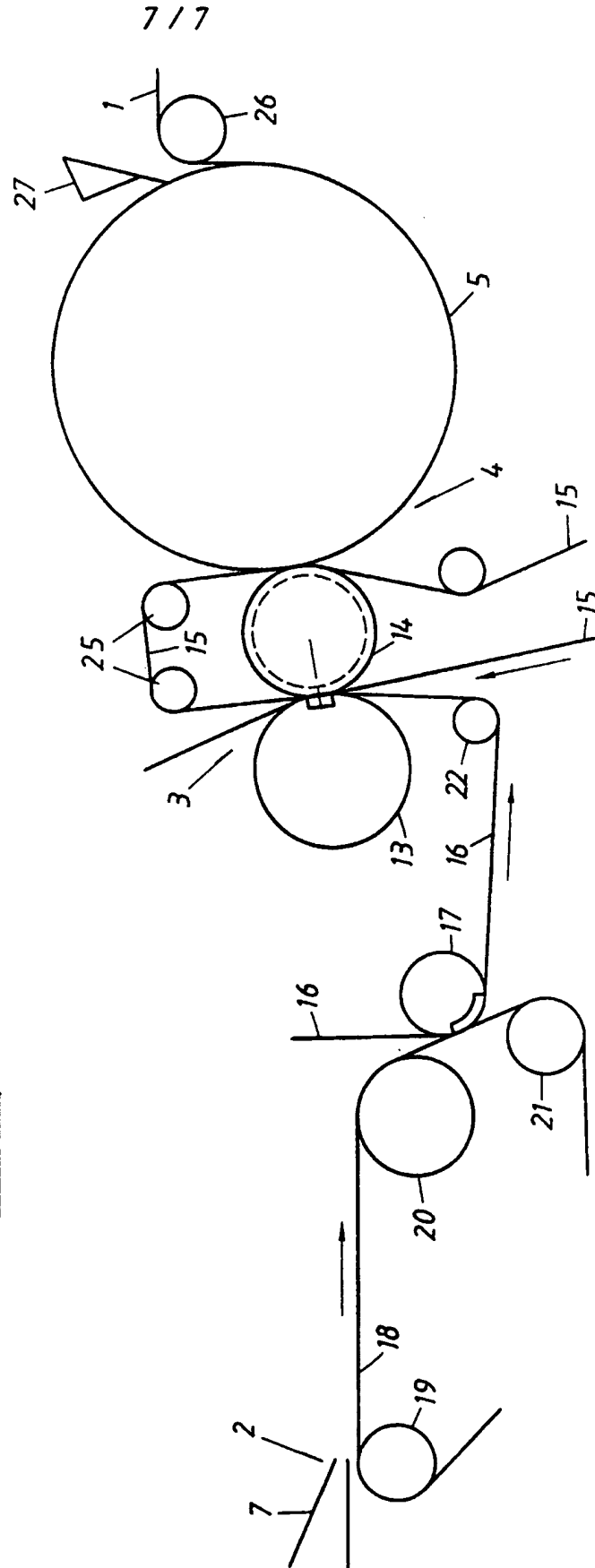


Fig. 7



INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 99/00090

A. CLASSIFICATION OF SUBJECT MATTER		
IPC6: D21F 9/00, D21F 3/02 According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols)		
IPC6: D21F		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
SE,DK,FI,NO classes as above		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5393384 A (KARL STEINER ET AL), 28 February 1995 (28.02.95) --	1,13
A	WO 9428240 A1 (J.M.VOITH GMBH), 8 December 1994 (08.12.94), figure 6 --	1,13
A	US 5500092 A (CHRISTIAN SCHIEL), 19 March 1996 (19.03.96) -- -----	1,13
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search		Date of mailing of the international search report
20 May 1999		10 -06- 1999
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86		Authorized officer Olov Jensen Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT
Information on patent family members

03/05/99

International application No.
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